

Extra Modes of Nutrition Answers

1.

- (a) (i) A goblet cell ;
- B crypt / glands of Lieberkuhn / Paneth cells;
(not : Brunners glands)
- C muscle;
- D villus / villi ; **4**
(not : microvilli)
- (ii) capillary; (not : arteriole) **2**
lacteal / lymph (vessel);
- (b) microvilli (on surface of cell);
large surface area ;
- (possess) many mitochondria ;
for active transport ; **4**
- produce mucus to aid lubrication / protection
- linked marks

2.

- (a) (i) 1. ingestion 2. digestion [2]
 3. absorption 4. egestion
 4 correct
 3 correct - 1 mark
- (ii) The breakdown of large, insoluble molecules into small soluble ones [1]

(b)

Enzyme	Substrate	Products	Site of secretion
pepsin	protein/ polypeptide	peptides	stomach/ gastric pits
peptidases	peptides	amino acids	Pancreas/ small intestine
lipase	lipids	fatty acids and glycerol	pancreas
(salivary) amylase	starch/amylose	maltose	salivary gland

1 mark for each correct row [4]

- (c) (i) Drawing showing brush border labelled [1]
 Drawing showing goblet labelled [1]
- (ii) Correct function of brush border cell [1]
 Correct function of goblet cell [1]
- (iii) Microvilli/brush border-large surface area/mitochondria-for active transport/'goblet' to store mucus/any feature of secretion, e.g. vesicles [1]

Total marks [12]

3.

- (a) starts in the mouth/ref. saliva/mechanical digestion (once only);
 amylase converts starch to maltose;
 (further) digestion in small intestine/duodenum;
 amylase from pancreas;
 maltase converts maltose to glucose;
 sucrase converts sucrose to glucose and fructose;
 digestion of disaccharides to monosaccharides in or on epithelial cells;
 ref. hydrolysis. Max. 5
- (b) (i) (sphincter) muscle/sphincter; 1
 (not : flap/peristalsis)
- (ii) disinfectant/kills bacteria;
 optimum pH/correct pH;
 activation of enzymes/named enzyme;
 acid digestion/acid helps breakdown; Max. 3
 ref. absorption of ions
 (not : stops amylase action)
- (iii) covered with mucus/alkaline layer. 1
- (iv) food (and acid) remain in stomach for 2-4 hours;
 acid contents being mixed with food (in stomach);
 more acid production stimulated once food in stomach;
 pH falls as more acid moves up into oesophagus. Max. 2
- Total [12]**

4.			
(a)	(i) Peristalsis (not: move or push food along)		[1]
	(ii) (Alkaline) mucus;		[1]
	(iii) Absorb fats/fatty acids etc.		[1]
(b)	(i) Hepatic portal		[1]
	(ii) Lymph		[1]
(c)	Alkaline mucus;		[1]
	Neutralise acid from stomach;		
	Correct pH for enzymes;		
	Lubrication;		
	Protection;	Any	[1]
(d)	(i) Surface area reduced;		
	Do not absorb substances so efficiently/reduced uptake.		[2]
	(ii) No/fewer microvilli;		
	Many enzymes involved with digestion are adsorbed onto the membranes of microvilli/ components of the membrane;		
	Catalytic surface reduced/surface area reduced for enzyme action.	2 Max	
			[11]

5.

- | | | |
|-----|--|---|
| (a) | B circled on drawing | 1 |
| (b) | (i) Temperature (kept at 37°C) / pH (2) / level of acidity | 1 |
| | (ii) <u>no</u> microbes / sterile / denature proteases or enzymes in beef | 1 |
| (c) | <u>in</u> stomach churning / mechanical digestion / separates fibres | 1 |
| | <u>presents</u> large surface area (for enzyme to act upon) / more ES complexes | 1 |
| | <u>continuous</u> enzyme production
(not: ref. to <u>HCl</u>) | |
| (d) | (i) 1. <u>trypsin</u> (ogen) / <u>chymo</u> ~
(not: <u>peptidases</u>) | 1 |
| | 2. <u>pancreas</u> | 1 |
| | (ii) <u>gut</u> wall / organs made of protein / secreting cells | 1 |
| | ∴ <u>active</u> enzyme would digest wall / organ / cells / prevents autolysis
(not: <u>cell</u> wall) | 1 |
| | (iii) <u>removal</u> of amino group/excess cannot be stored / ref. to urea | 1 |
| | <u>so</u> that remainder of molecule may be stored / utilised / converted to carbohydrate. | 1 |

[12]

6.

- (a) (i) mouth/buccal cavity and stomach; 1
- (ii) increases surface area (of food) for enzyme action/
chemical digestion; 1
- (b) (i) fats converted to fatty acids; 1
- (ii) emulsify / breakdown fat droplets into smaller droplets; 1
increase surface area of lipid for activity of lipase/enzyme; 1
- (iii) neutralise stomach acid / excretion of bile pigments /
form micelles for absorption of vitamins; 1
(not: ensures correct pH for enzyme action/neutralisation)
- (c) glucose / monosaccharides/disaccharides into capillaries;
amino acids into capillaries;
fatty acids + glycerol into lacteal;
some fatty acids and glycerol enter capillaries;
lymphatic system to thoracic duct;
correct reference to active transport;
correct reference to diffusion;
correct reference to mechanics of fat transport. 5
(Max. 5)
- (d) (xs) lipid and (xs) carbohydrate stored as fat/adipose tissue; 1
(xs) amino acids deaminated and enter carbohydrate metabolism/
stored as fat. 1
(not: reference to glycogen)

[13]

7.

- | | | | |
|-----|------|--|-----|
| (a) | (i) | amylase | 1 |
| | (ii) | amylase/starch is broken down to maltose.
(not: maltose and glucose) | 1 |
| (b) | (i) | there is no amylase/starch digesting enzyme in stomach tissue.
(not: ref. to acid/pH; allow consequential error from (a) (i)) | 1 |
| | (ii) | duodenum tissue does not secrete amylase, pancreas does. | 1 |
| (c) | | 5cm ³ starch suspension + 2cm ³ deionised/distilled water/boiled tissue | 1 |
| | | | [5] |

8.

- | | | | |
|-----|------|---|---|
| (a) | | buccal cavity/mouth;
stomach;
duodenum; (Allow small intestine) | 3 |
| (b) | | (exopeptidases) detach single amino acids from the end of the chain/hydrolyse terminal peptide bond;
(endopeptidases) break protein molecules into shorter chains of amino acids/hydrolyse peptide bonds within the protein molecule;
(allow: cut end and middle of molecule (1); (cutting) protein/peptide bond/amino acids (1)) | 2 |
| (c) | (i) | A villus;
B goblet cell;
C crypt of Lieberkhun; (not: brunners gland)
D circular muscle; | 4 |
| | (ii) | L pointing to villus surface or inside epithelium cell; must touch epithelium (not: in crypt)
M pointing to capillary;
N pointing to lacteal;
(M and N in villus, must touch line) | 3 |
| (d) | | adds bulk;
stimulates peristalsis/prevents constipation; (allow: ref. to muscle)
prevents bowel problems/disease;
ref. soluble fibre;
(Any 2) (not: fibre/roughage/expel excrement unqualified/aids movement of food) | 2 |

[14]

9.			
(a)	(i)	A goblet cells B paneth cells enzymes/named C Brunners glands	4
	(ii)	(enzymes: peptidase; maltase; enterokinase ; lactase; sucrase) protect gut wall from autolysis(self-digestion) / enzymes / acid; neutralise the acid (from the stomach); lubricates the gut lining (as the contents are moved along). Any 2× 1 mark each	2
(b)		folded ; numerous villi; microvilli / brush border Any 2×1 each	2
(c)		X is the capillaries; which take up water soluble end products or example;	2
		Y is the lacteal/lymph duct/lymph vessel which absorbs lipids and fat soluble materials/fatty acids and glycerol	2
			[12]

10.

mouth ;	starch	maltose; (not: disaccharide/sugar)	(2)
stomach ;	protein	peptides/polypeptides; (not: amino acids)	(2)
small intestine ;	protein	peptides/polypeptides/converts chymotrypsin;	(2)
small intestine ;	lipid	fatty acids and glycerol;	(2)
(for site must be reference to lumen not surface)			

Total 8 marks

Essays

1.

- (b)
- A Absorption occurs in ileum/ good capillary supply;
 - B Surface area increased by villi and microvilli;
 - C Glucose/monosaccharides absorbed by facilitated diffusion / active transport;
 - D Any mention of sodium dependent glucose transporters;

 - E Glucose diffuses down the concentration gradient (facilitated diffusion) into the **capillary/ blood** in the villus;
 - F Amino acids taken up by (active transport);

 - G Blood travels from the gut to the liver via the hepatic portal vein;

 - H Fatty acids and glycerol / monoglycerides (enter the epithelium) by diffusion across the plasma membrane;
 - I Micelles fuse with/bump into the brush border and the lipids / monoglycerides /fatty acids / glycerol are absorbed;

 - J Lipids move into lacteal/secretion of lipid containing vesicles / chylomicrons into **lacteal**;

 - K Through lymphatic system rejoining bloodstream at thoracic duct/ into subclavian vein;

 - L Glucose used for respiration / stored as glycogen / lipid ;

 - M Amino acids used for protein synthesis;

 - N Excess deaminated and amino groups converted to urea / remainder enters respiration;
 - O Lipids used for membranes / hormones /stored as fat

2.

- (a)
- | | | |
|----|---|--------|
| A. | mechanical digestion in mouth and stomach; | 1 mark |
| B. | chemical /enzyme digestion starts in stomach; | 1 mark |
| C. | rennin in correct context
(not: breaks protein down) | 1 mark |
| D. | pepsinogen produced by chief cells/gastric glands; | 1 mark |
| E. | activated to pepsin by HCl/pepsin; | 1 mark |
| F. | endopeptidase ; | 1 mark |
| G. | proteases secreted by pancreas and ileum;
(not: small intestine) | 1 mark |
| H. | activated by alkaline conditions; | 1 mark |
| I. | endopeptidase and exopeptidase | 1 mark |
| J. | dipeptides to amino acids on surface of cells or inside cells; | 1 mark |
| K. | absorption in ileum/villi; | 1 mark |
| L. | into capillaries by diffusion/active transport;
(not: blood/blood vessels) | 1 mark |
| M. | to liver by hepatic portal vein; | 1 mark |
| N. | used in protein synthesis; | 1 mark |
| O. | excess deaminated and stored; | 1 mark |
| P. | AVP; e.g. enzymes on surface of epithelium of villi/
transamination etc | 1 mark |

(A maximum of 10 marks may be awarded from the 16 available)

3.

Digestion question

(a) A Bile from liver (contains bile salts)

B Passes along bile duct to duodenum

C Where bile salts emulsify fats (into water miscible droplets)

D Pancreatic juice (secreted into duodenum) contains lipase

E Which splits fats into fatty acids and glycerol

F Lipase digestion continued in small intestine

G Absorption into lymphatic system via lacteals in small intestine villi
(mark for villi once only - either here or point O)

Award mark G and any four from A-F (5)

(b) H Protein breakdown to polypeptides by pepsin in stomach

I Role of HCl/acid in activating pepsinogen to pepsin

J Polypeptides also produced by trypsin/chymotrypsin in pancreatic juice

K Intestinal juice contains endo- and exopeptidases

L Which cleave the middle of a peptide or remove the end amino acid group (respectively)

M Di and tri peptides are digested intracellularly

N Or on the cell surface of the ileum epithelium

O To amino acids which enter the capillaries in the villi

Award mark O and any four from H-N (5)

Total 10 marks